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I, JENNY SHANNON, EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2004904004 for a patent by JETSTONE BUILDING SYSTEMS PTY LTD as filed on 20 July 2004.

I further certify that pursuant to the provisions of Section 38(1) of the Patents Act 1990 a complete specification was filed on 17 January 2005 and it is an associated application to Provisional Application No. 2004904004 and has been allocated No. 2005204590.

WITNESS my hand this
Twentieth day of April 2010

JENNY SHANNON
EXAMINATION SUPPORT AND SALES

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant:

JETSTONE BUILDING SYSTEMS PTY LTD

Invention Title:

COMPOSITE CONSTRUCTIONAL ELEMENT AND METHOD OF MANUFACTURING A COMPOSITE CONSTRUCTIONAL ELEMENT

The invention is described in the following statement:

COMPOSITE CONSTRUCTIONAL ELEMENT AND METHOD OF MANUFACTURING A COMPOSITE CONSTRUCTIONAL ELEMENT

FIELD OF THE INVENTION

The present invention relates to a composite constructional element and a method of manufacturing such a composite constructional element. In particular, the constructional element is of the type suitable for constructing a wall, floor or roof.

BACKGROUND TO THE INVENTION

Building systems in the form of prefabricated modular building systems have a tendency to rely upon heavy machinery for their construction, are generally labour intensive and may require many different tradespersons for construction. Although such systems may be modular, they may require the separate construction and application of external and internal finishes. An example of components of a prefabricated modular building system is aluminium cladding. Such cladding is typically positioned and fixedly located on the exterior of a fibre panel or wood panel building structure.

WO02/35026 discloses a constructional element including a structural member in the form of a hollow steel box section and cladding formed about at least part of the structural member. The cladding is formed of a cement based material such as fibre cement. The cladding is moulded around the structural member and includes a abutment means in the form of a protrusion along one edge and a mating channel along the other edge, so that

adjacent constructional elements can be aligned. The constructional elements are fixed at their ends to support elements.

The system of WO02/35026 has the advantage that the cladding material can be provided with a number of different finishes.

SUMMARY OF THE INVENTION

According to the present invention, a composite constructional element comprises:

a plank profile forming a rear face and two opposed edge sections of the constructional element, each edge section including an edge face; and

a cladding material moulded into the plank profile such that it is retained by the rear face and the opposed edge faces,

wherein the plank profile further comprises at least one retaining formation shaped to retain the moulded cladding material attached to the plank profile.

According to a second aspect of the present invention, a method of manufacturing a composite constructional element comprises the steps of:

providing a plank profile comprising a rear face and two opposed edge sections, each edge section including an edge face; and

moulding a cladding material into the plank profile such that it is retained by the rear face and the opposed edge faces,

wherein the plank profile further comprises at least one retaining formation shaped to retain the moulded cladding material attached to the plank profile.

In the present invention, the cladding material is moulded into the plank profile. Thus, the plank profile itself forms the mould, and there is no requirement for a separate step of moulding the cladding material around a structural member. The resulting composite constructional element can be made thinner and lighter than prior art constructional elements. The cladding material can be provided with a number of different finishes to resemble masonry. The retaining formations are formed as part of the plank profile and therefore part of the mould for the cladding material and are shaped to retain the cladding material attached to the plank profile. The cladding material is moulded into or around the retaining formations.

Preferably, the retaining formations are formed adjacent to or as part of the edge sections. This has the advantage that, if there are differences in the expansion or contraction of the plank profile and the cladding material with changes in temperature, the plank profile and the cladding material can bow such that they separate slightly in the centre but are retained attached at the edges. This prevents cracking of the cladding material.

Preferably, the retaining formations comprise longitudinal channels of substantially uniform cross section and filled with cladding material, and being

shaped in cross section to retain the moulded cladding material attached to the plank profile.

Preferably, the cladding material forms substantially an entire front face of the constructional element, which is preferably substantially flat. Thus, there is little or no part of the plank profile visible when the constructional elements are assembled, for instance, to form a wall.

Preferably, each edge section includes an attachment formation for attachment to a mating attachment formation on an adjacent constructional element.

Preferably, the attachment formations comprise a frontwardly facing channel formed on one edge section and a rearwardly projecting lip formed on the opposed edge section, wherein the lip is capable of clipping into a channel on an adjacent constructional element.

Preferably, the lip includes a recess such that, when clipped into a mating channel on an adjacent constructional element, a recess is defined between a base of the mating channel and the lip. This allows for the head of a fastening means such as a hex screw to be accommodated in the recess when the lip is engaged in the channel. The fastening means may be used to fasten the constructional element to a building element through the base of the channel, and when an adjacent constructional element is clipped in position, the fastening means is hidden from view.

Preferably, the channel projects outwards beyond one edge face, and the lip is formed inwards from the opposed edge face.

Preferably, the lip comprises one of the retaining formations.

In one embodiment, the channel is formed as a separate piece and includes a depending portion which extends over the adjacent edge face and is embedded in the cladding material. Alternatively, the plank profile, including the rear face, the edge sections and the attachment formations, is integrally formed from a sheet material.

Preferably, the plank profile is formed from sheet steel, which preferably is roll formed. This is a particularly simple and effective manufacturing method for forming such profiles.

Preferably, the plank profile includes at least one longitudinal stiffening formation comprising a ridge. This is particularly useful when the constructional elements are used to form a load bearing structure such as a floor. The or each ridge can be formed as a channel in the plank profile which is filled with cladding material.

Preferably, the cladding material is cement, concrete, fibre cement, fibreglass, cellulose, foamed polymeric material, ceramics or polystyrene, but glass reinforced cement is the most preferred material.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a side elevation showing a plurality of interconnected constructional elements according to a first embodiment of the invention;

Figure 2 is a side elevation illustrating a plurality of interconnected constructional elements according to a first embodiment of the invention forming a corner;

Figure 3 is an elevated view of a join between ends of constructional elements according to a first embodiment of the invention;

Figure 4 is an exploded section of a constructional element according to a first embodiment of the invention and a sealing element;

Figure 5 is a side elevation of a plank profile for a constructional element according to a second embodiment of the invention;

Figure 6 is an exploded view of a constructional element according to a second embodiment of the invention;

Figure 7 is a part sectional view of interconnected edge sections of constructional elements according to a second embodiment of the invention;

Figures 8a and 8b illustrate the edge section of a constructional element in accordance with a third embodiment of the invention;

Figures 9a and 9b illustrate an edge section of a constructional element according to a fourth embodiment of the invention;

Figure 10 illustrates a method of attachment for a constructional element according to the invention; and

Figure 11 illustrates an alternative method of attachment for a constructional element according to the invention.

DETAILED DESCRIPTION

Figures 1 to 4 illustrate a first embodiment of a constructional element according to the invention.

Figure 1 illustrates a plurality of constructional elements 1 interconnected to form cladding for fixing to the outside of a wall. Each composite constructional element 1 comprises a plank profile 2 and a cladding material 3. The plank profile 2 could be formed from a number of suitable materials including plastics, fibre glass or carbon fibre, but in this preferred embodiment, the plank profile 2 is formed from sheet steel. The cladding material 3 could be cement, concrete, fibre cement, fibre glass, cellulose, foamed polymeric material, ceramics or polystyrene, but is preferably a cement based material, and in this preferred embodiment, the cladding material 3 is glass reinforced cement. Glass reinforced

cement is a known product that is currently used for moulding and casting building panels and architectural details.

The folded plank profile 2 includes a first edge section 4, a second edge section 5 and a rear face 6, which form a mould for the cladding material 3.

The first edge section 4 includes an edge face 4a which projects frontwards with respect to the rear face 6, and acts to retain cladding material 3 at one edge of the constructional element 1. The first edge section 4 also includes an attachment formation in the form of a lip 4b which projects backwards from the rear face 6. The lip formation 4b is formed as a channel in the plank profile 2 which is filled with cladding material 3. The lip 4b also acts as a retaining formation. Because of its dovetail cross sectional shape, when the cladding material 3 is moulded into the lip 4b, it is retained attached to the plank profile 2.

The second edge section 5 includes an edge face 5a which projects frontwardly from the rear face 6 and acts to retain cladding material 3 at the opposed edge of the constructional element 1. The second edge section 5 also includes a second attachment portion in the form of a channel 5b which projects laterally beyond the second edge face 5a. The channel 5b extends backwards from the rear face 6 and is shaped to receive lip 4b of an adjacent constructional element 1. Located inwards from the second edge face 5a is a second retaining formation 5d, formed as a dovetail shaped channel in the plank profile which is filled with cladding material 3. Because of its shape,

when the cladding material 3 is moulded into the second retaining formation 5d, it is retained attached to the plank profile 2.

Because the two retaining formations 4b, 5d are located at or adjacent the edges of the plank profile 2, if the thermal expansion of the plank profile 2 and the cladding material 3 differs, then the plank profile 2 can bend slightly and become delaminated from the cladding material 3 at the centre, whilst being maintained attached by the retaining formations 4b, 5d. This prevents cracking of the cladding material 3 under extreme high or low temperature conditions.

The rear face 6 also includes longitudinal ridge formations, 6b, 6c, which are formed as channels projecting backwardly from the plane of the rear face 6. These channels 6b, 6c are filled with cladding material 3 and serve to stiffen the constructional element 1.

In the embodiment of figures 1 to 4, the entire plank profile 2 is formed from a single sheet of steel. In this embodiment, the plank profile 2 is formed by roll-forming. The process of roll-forming involves the feeding of a flat profile of light gauge steel through a roll-forming machine to provide a desired profile. This is a well-known and widely used technology for the purpose of making roof sheeting, wall studs etc. Once the profile 2 is formed, the cladding material 3 is moulded into the plank profile such that it is bounded by the rear face 6 and the edge faces 4a, 5a. The cladding material 3 covers substantially an entire front face of the building element and forms a flat front surface. The only part of the front face of the

constructional element which is not covered by the cladding material 3 is the edge section 5. When the constructional elements 1 are interconnected, the edge section 5 is substantially covered by an adjacent constructional element 1 as the lip 4b clips into channel 5b. A narrow portion 5c remains exposed, which may be reduced to a width of approximately 2-3mm and which may be covered by an appropriate joint compound.

The constructional element 1 can be formed by this method and supplied in standard lengths which can be readily cut to any required length. Because the rolled steel profile 2 acts as a mould for the cladding material 3, the method of manufacturing does not require any separate moulding step, thus eliminating the need for any separate moulds, and the associated storage, handling and cleaning of such.

To assemble the constructional elements 1 to form cladding or panelling on a wall, a first constructional element 1 is fixed to an upright in the form of a timber upright 8 by screws which are fixed through screw holes 7 which are located at the base of channel 5b. Alternatively, self-drilling screws, rivets, staples, or nails, may be used, in which case the screw holes 7 are not required. Once a first constructional element 1 is fixed to the upright 8, a second constructional element 1 is positioned by clipping lip 4b into channel 5b of the first constructional element 1 which is fixed to the upright 8. The screws 7 are concealed by the overlying second constructional element 1. The second constructional element can then be screwed to the upright 8. The

constructional elements 1 can also be fixed to a frame having a steel stud in a similar way. The constructional elements 1 are particularly thin, in this preferred embodiment having a thickness of approximately 20mm, and thus, when used as cladding or panelling on a wall, the floor space of the room is not substantially reduced. The constructional elements 1 are also light and easy to handle, and require no specially adapted support structure but can be screwed to any conventional frame or wall.

Ends of constructional elements 1 can be joined by means of a sealing element 10, which is preferably formed from a waterproof plastics material such as neoprene. The sealing element 10 can be provided directly between the ends of constructional elements 1, as illustrated in Figures 2 and 4, or between the ends of constructional elements 1 and a joining member 11 as illustrated in Figures 1 and 3. The joining member 11 is provided as a U shaped channel, wherein constructional elements 1 abut each side with a sealing element 10 interposed therebetween. A cover member 12 can be clipped into the joining member 11, which is screwed to the frame or wall by screws 13.

Figures 1 and 2 also illustrate corner members 14 which are screwed to a timber upright 8 and have flanges which abut the ends of the constructional elements 1. A sealing element 10 is provided between the ends of the constructional elements and the flanges 14a, 14b. The corner members 14, and joining members 11 can also be manufactured from roll formed steel.

Figures 5 to 7 illustrate a second embodiment of a constructional element according to the invention. Figure 5 illustrates a plank profile 2 without moulded cladding material 3, and Figure 6 is an exploded view showing the cladding material 3 separated from the plank profile 2.

As shown in Figures 5 and 6, the constructional element of the second embodiment has generally the same features as that of the first embodiment. The folded plank profile 2 includes a first edge section 4, a second edge section 5 and a rear face 6, which form a mould for the cladding material 3. As in the first embodiment, the first edge section 4 includes an edge face 4a which retains cladding material 3 at one edge of the constructional element 1, and the second edge section 5 includes an edge face 5a which acts to retain cladding material 3 at the opposed edge. An attachment portion in the form of a channel 5b project laterally beyond the second edge face 5a, and a second retaining formation 5d is formed inwards from the edge face 5a. The second retaining formation 5d, as in the first embodiment, comprises a dovetail shaped channel in the plank profile.

The edge section 4 includes an attachment formation in the form of a lip 4b which is shaped for clipping engagement with a channel 5b on an adjacent constructional element 1. The lip 4b is shaped to also act as a retaining formation due to its cross sectional profile which means that, once the cladding material 3 is moulded into the lip 4b, it is retained attached to the plank profile 2. In the second embodiment, the lip 4b includes a recessed channel 4d on its underside. As illustrated in figure 7, the recessed channel 4d accommodates the head of a fastening

means such as a hex screw 20 when the constructional element is clipped to an adjacent constructional element. The hex screw 20 is screwed through the base of channel 5b to attach the adjacent constructional element 1 to a support or upright. Thus the second embodiment allows the use of hex screws 20 for fastening the constructional elements to an upright, whereas the first embodiment requires the use of fasteners which are flush to the base of the channel 5b.

Figures 8 and 9 illustrate third and fourth embodiments of the invention, in which, rather than the entire plank profile 2 being formed from a single sheet, the channel 5b is formed as a separate piece.

Figures 8a and 9a illustrate the separate piece comprising a channel 5b, and exposed section 5c and an L-shaped depending portion 5e. Figures 8b and 9b illustrate the channel section assembled with the remainder of the plank profile 2 to form a constructional element 1. The depending portion 5e extends over edge face 5a into retaining formation 5d. The L-shaped depending portion 5e is dimensioned such that one side has the same length as edge face 5a and, when assembled, abuts the edge face 5a. The other side of the L shaped depending portion 5e has the same length as the base of retaining formation 5d and, when assembled, abuts the base of retaining formation 5d. Once the channel portion is assembled with the remainder of the plank profile, the cladding material can be moulded and will fill retaining formation 5d such that the depending portion 5e is embedded in the moulded cladding material 3.

The advantage of providing the channel portion as a separate piece is that it simplifies the roll forming required to make the plank profile 2. Also, the separate piece covers the cut edge of the plank profile 2, thus reducing corrosion. Furthermore, different channel portions can be provided depending on the finish required. As shown in figures 8a and 8b, the exposed section 5c can be minimised. Alternatively, as shown in figures 9a and 9b, a larger exposed section 5c can be provided. In the embodiment of figures 9a and 9b, the channel section may be manufactured from a different material such as brass or colour bonded steel to give an attractive finish to the exposed portion 5c.

Figures 10 and 11 illustrate alternative means for attaching the constructional elements to a structure. Figure 10 shows a clip portion 30 which is screwed to a wall or upright and which is shaped to engage with one of the retaining formations 4b, 5d. In figure 11, the clip portion 30 is integrally formed as part of a c-section upright 31.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

It is to be understood that a reference herein to a prior art publication does not constitute an admission

that the publication forms a part of the common general knowledge in the art in Australia, or any other country.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A composite constructional element comprising:

a plank profile forming a rear face and two opposed edge sections of the constructional element, each edge section including an edge face; and

a cladding material moulded into the plank profile such that it is retained by the rear face and the opposed edge faces,

wherein the plank profile further comprises at least one retaining formation shaped to retain the moulded cladding material attached to the plank profile.

2. A composite constructional element according to claim 1, wherein the retaining formations are formed adjacent to or as part of the edge sections.

3. A composite constructional element according to claim 1 or 2, wherein the retaining formations comprise longitudinal channels of substantially uniform cross section and filled with cladding material, and being shaped in cross section to retain the moulded cladding material attached to the plank profile.

4. A composite constructional element according to any one of the preceding claims, wherein the cladding material forms substantially an entire front face of the constructional element.

5. A composite constructional element according to any one of the preceding claims, wherein each edge section includes an attachment formation for attachment to a

mating attachment formation on an adjacent constructional element.

6. A composite constructional element according to claim 5, wherein the attachment formations comprise a frontwardly facing channel formed on one edge section and a rearwardly projecting lip formed on the opposed edge section, wherein the lip is capable of clipping into a channel on an adjacent constructional element.

7. A composite constructional element according to claim 6, wherein the lip includes a recess such that, when clipped into a mating channel on an adjacent constructional element, a recess is defined between a base of the mating channel and the lip.

8. A composite constructional element according to claim 6 or 7, wherein the channel projects outwards beyond one edge face, and the lip is formed inwards from the opposed edge face.

9. A composite constructional element according to claim 8, wherein the channel is formed as a separate piece and includes a depending portion which extends over the adjacent edge face and is embedded in the cladding material.

10. A composite constructional element according to any one of claims 6 to 9, wherein the lip comprises one of the retaining formations.

11. A composite constructional element according to any one of claims 1 to 8, wherein the plank profile, including the rear face, the edge sections and the attachment formations, is integrally formed from a sheet material.

12. A composite constructional element according to any one of the preceding claims, wherein the plank profile is formed from sheet steel.

13. A composite constructional element according to claim 12, wherein the plank profile is roll formed.

14. A composite constructional element according to any one of the preceding claims, wherein the plank profile includes at least one longitudinal stiffening formation comprising a ridge.

15. A composite constructional element according to any one of the preceding claims, wherein the cladding material is cement, concrete, fibre cement, fibreglass, cellulose, foamed polymeric material, ceramics or polystyrene.

16. A composite constructional element according to any one of the preceding claims, wherein the cladding material is glass reinforced cement.

17. A method of manufacturing a composite constructional element comprising the steps of:

providing a plank profile comprising a rear face and two opposed edge sections, each edge section including an edge face; and

moulding a cladding material into the plank profile such that it is retained by the rear face and the opposed edge faces,

wherein the plank profile further comprises at least one retaining formation shaped to retain the moulded cladding material attached to the plank profile.

18. A method according to claim 17, wherein the plank profile is roll formed from sheet steel.

19. A method according to claim 16 or 17, wherein the plank profile comprises the only mould for moulding the cladding material.

Dated this 20th day of July 2004

JETSTONE BUILDING SYSTEMS PTY LTD

By their Patent Attorneys

GRIFFITH HACK

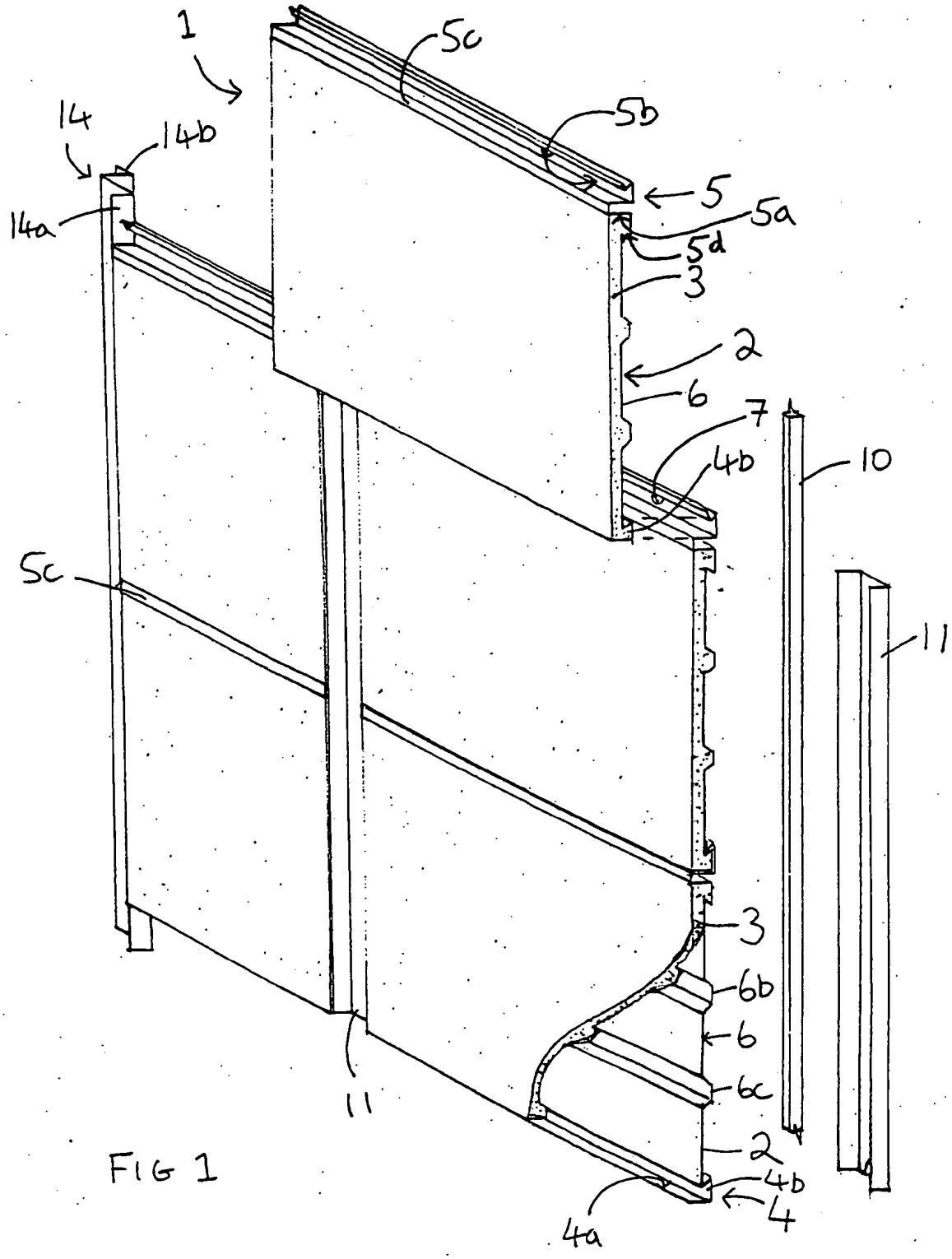


FIG 1

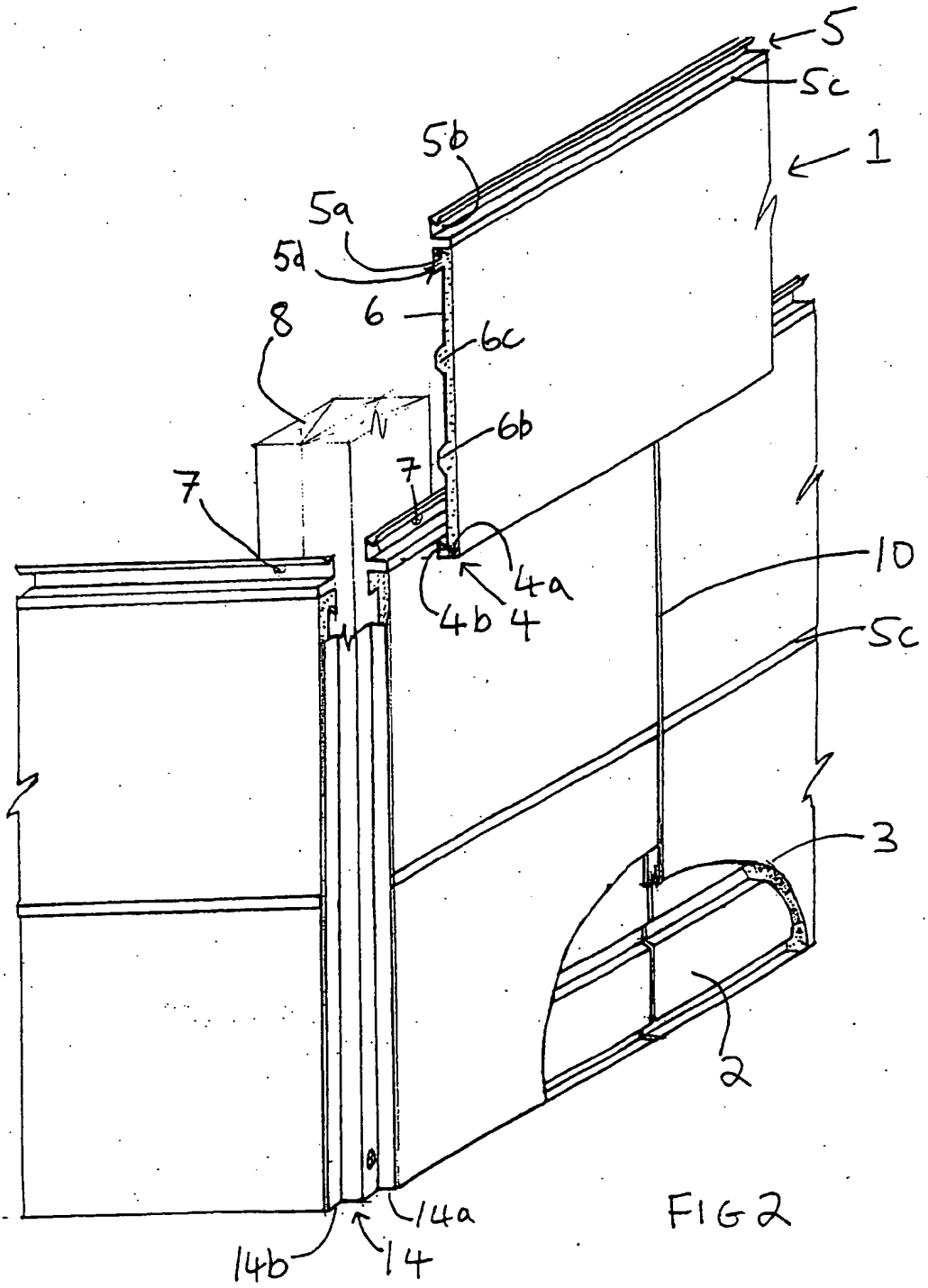


FIG 2

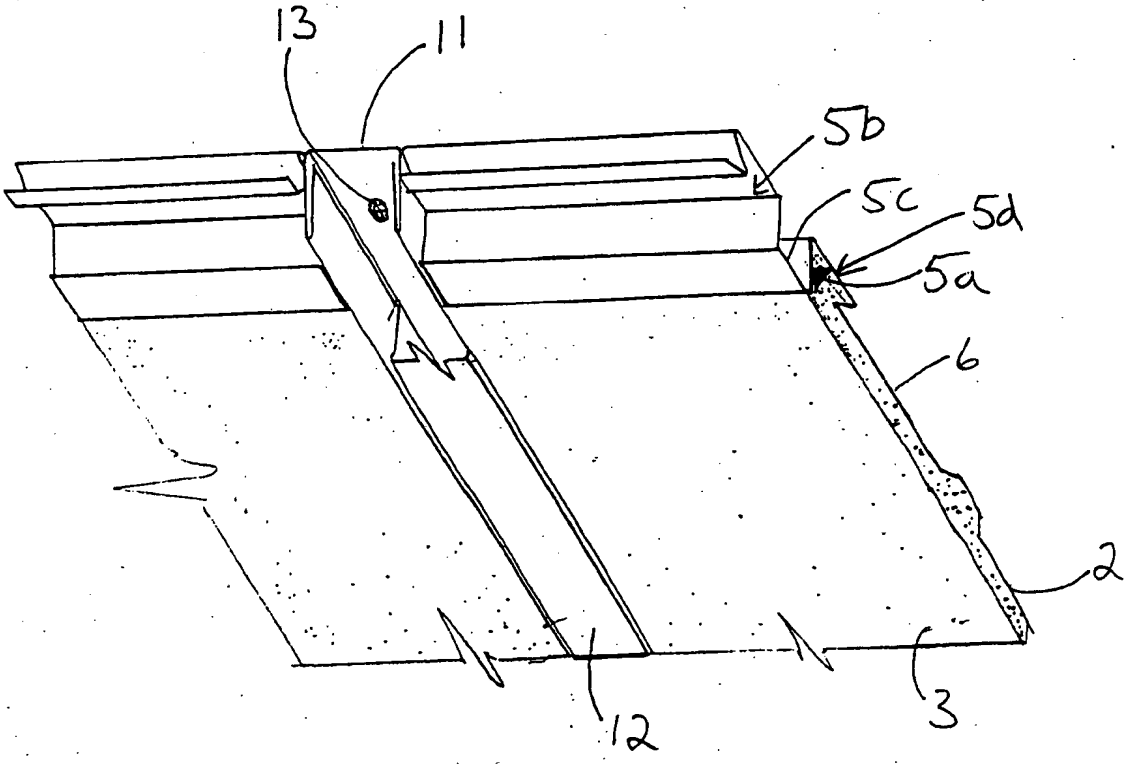


FIG 3

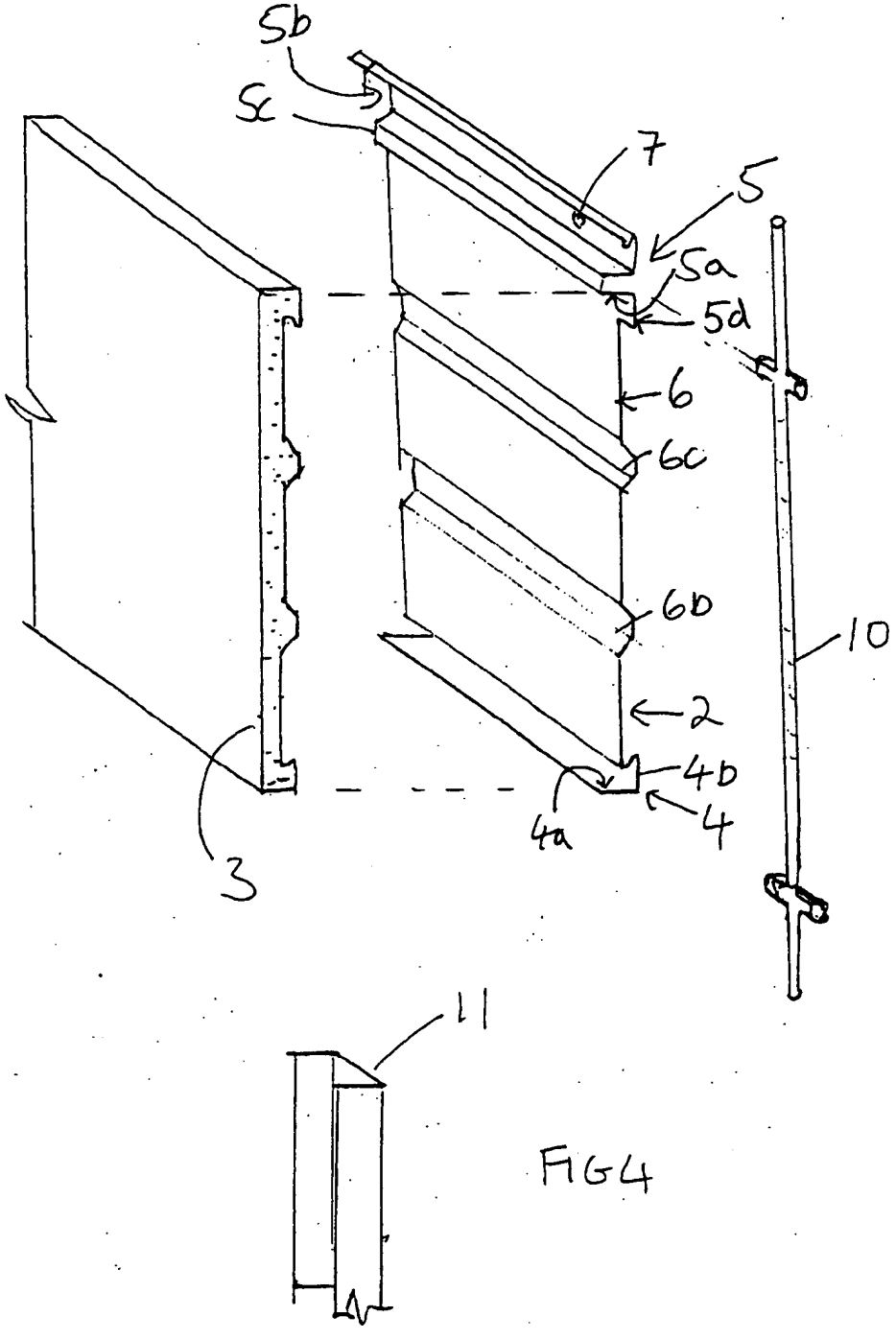


FIG4

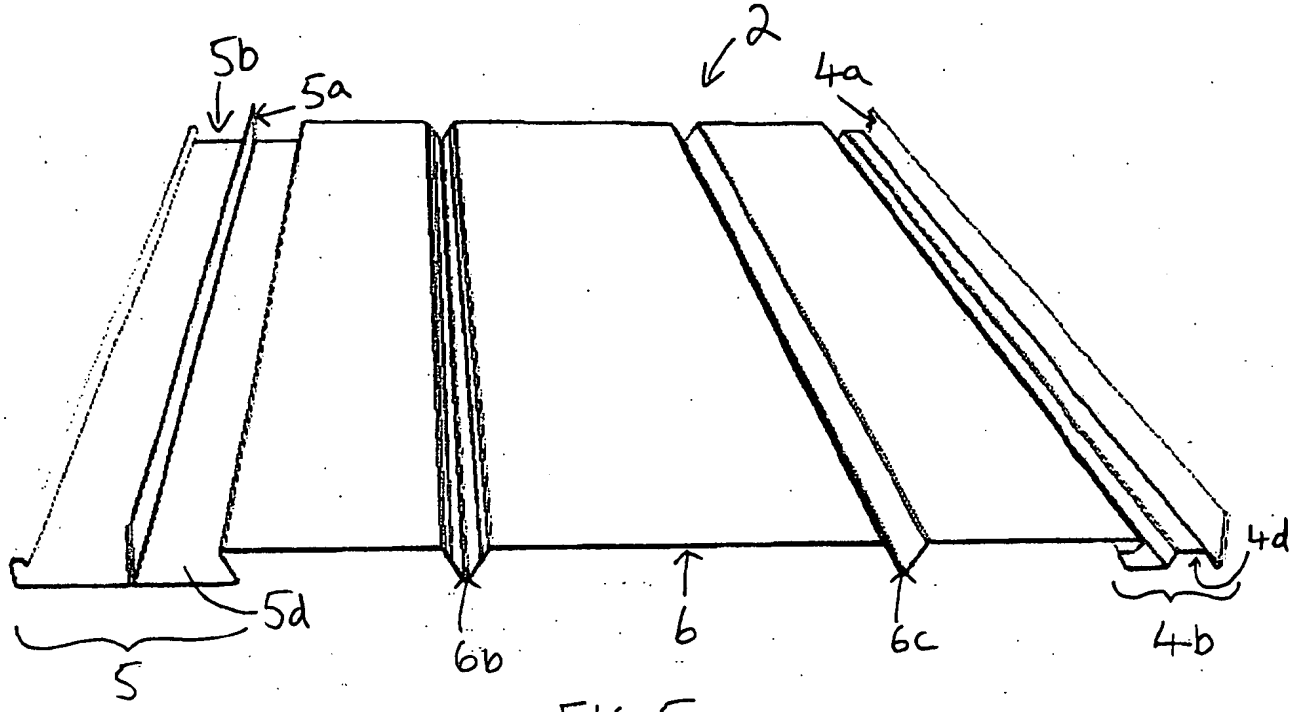


FIG 5

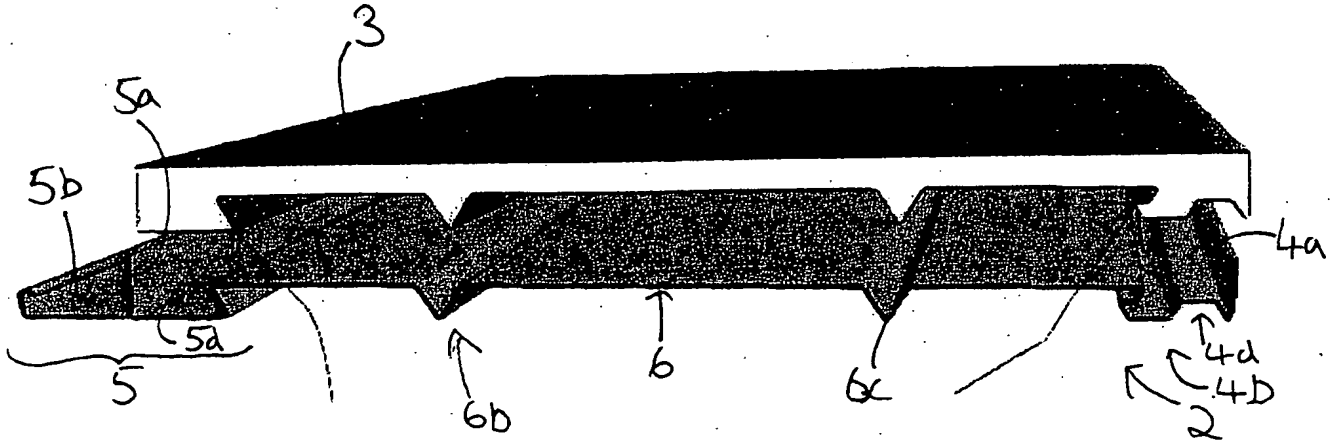


FIG 6

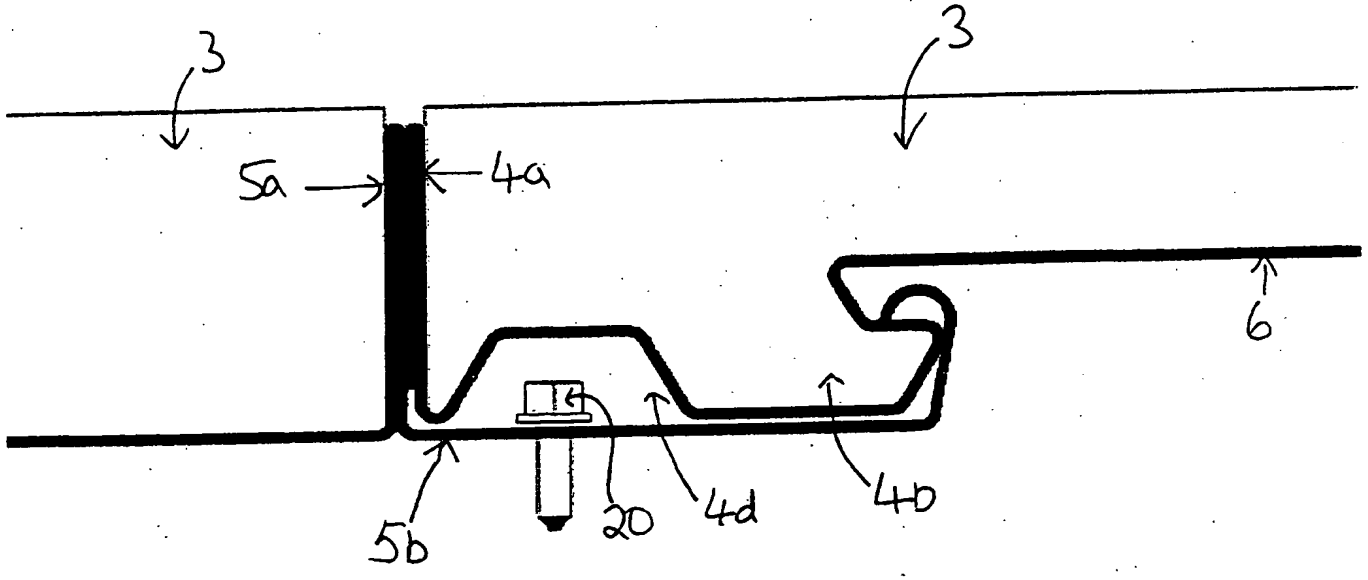


FIG 7

FIG 8A

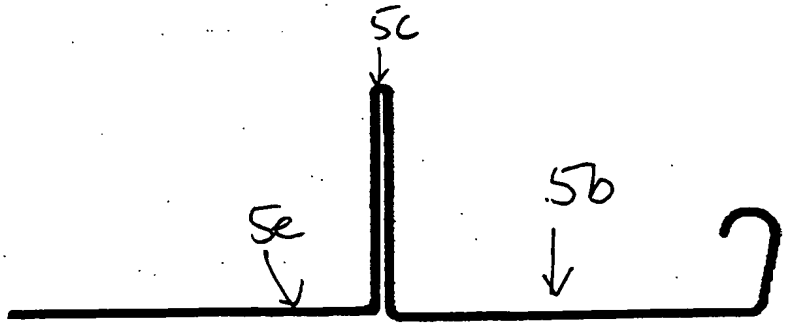


FIG 8B

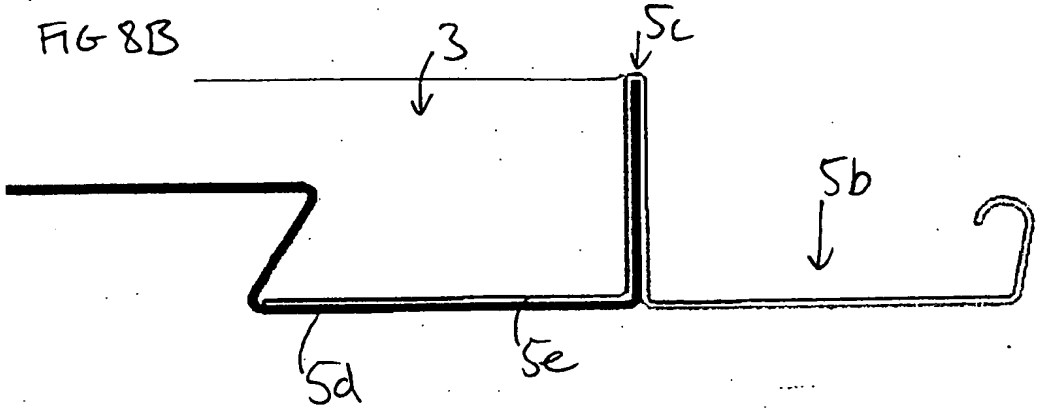


FIG 9A

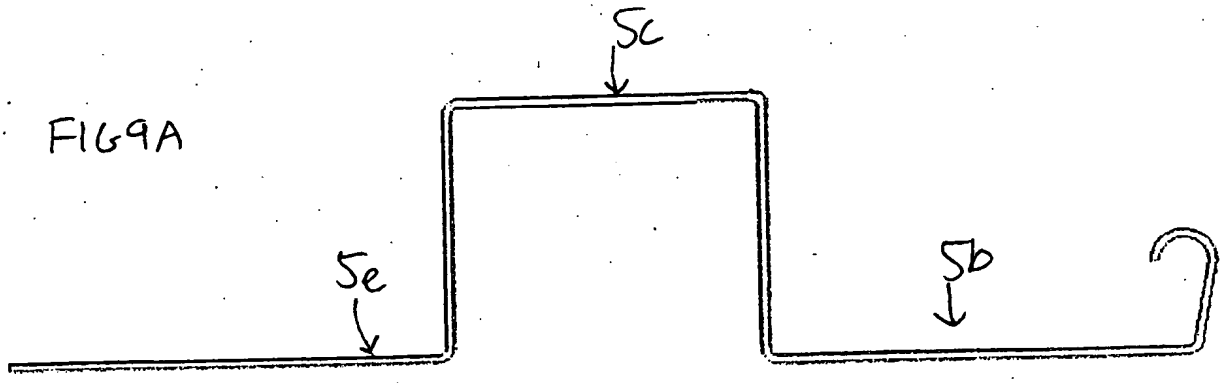


FIG 9B

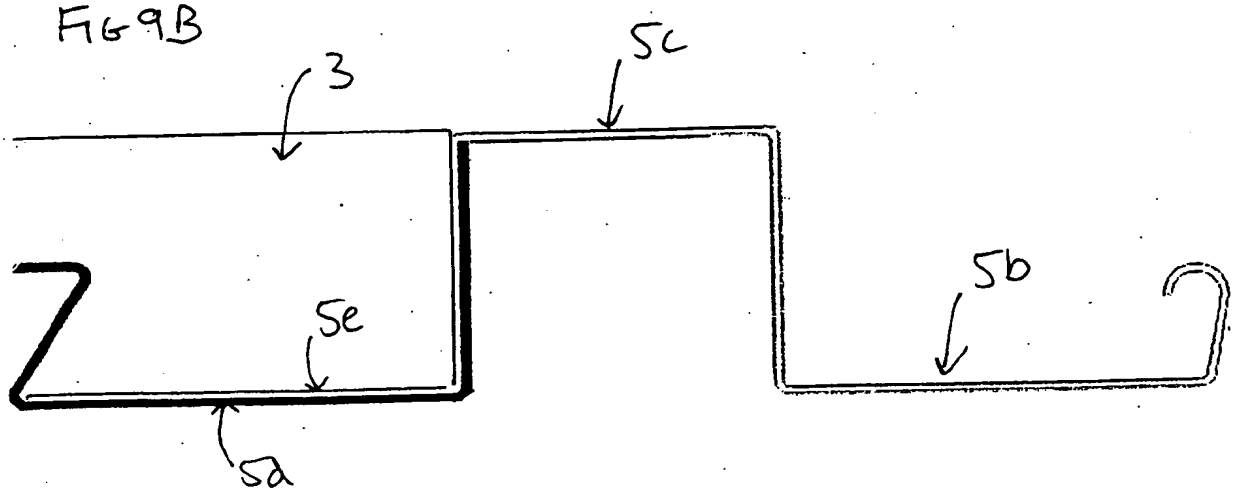
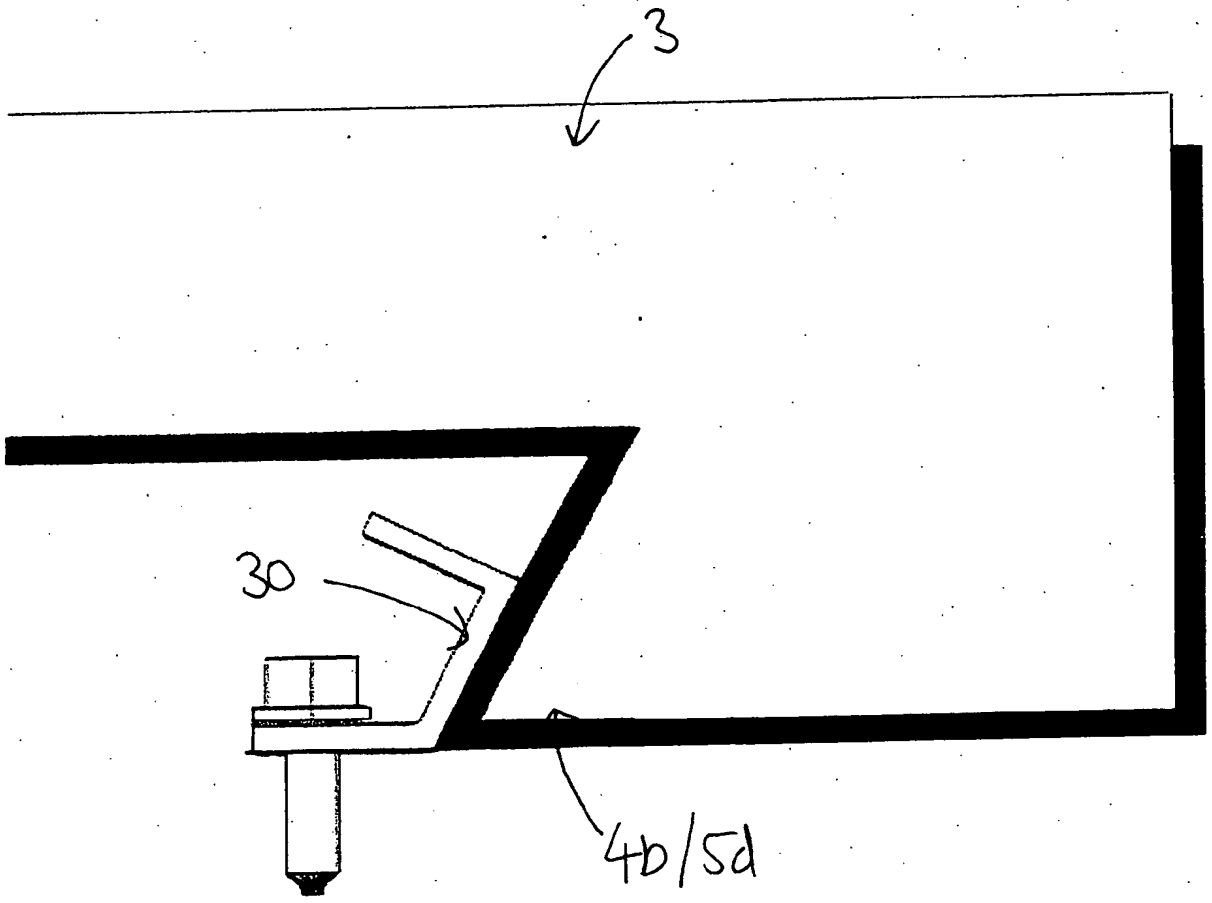


FIG 10



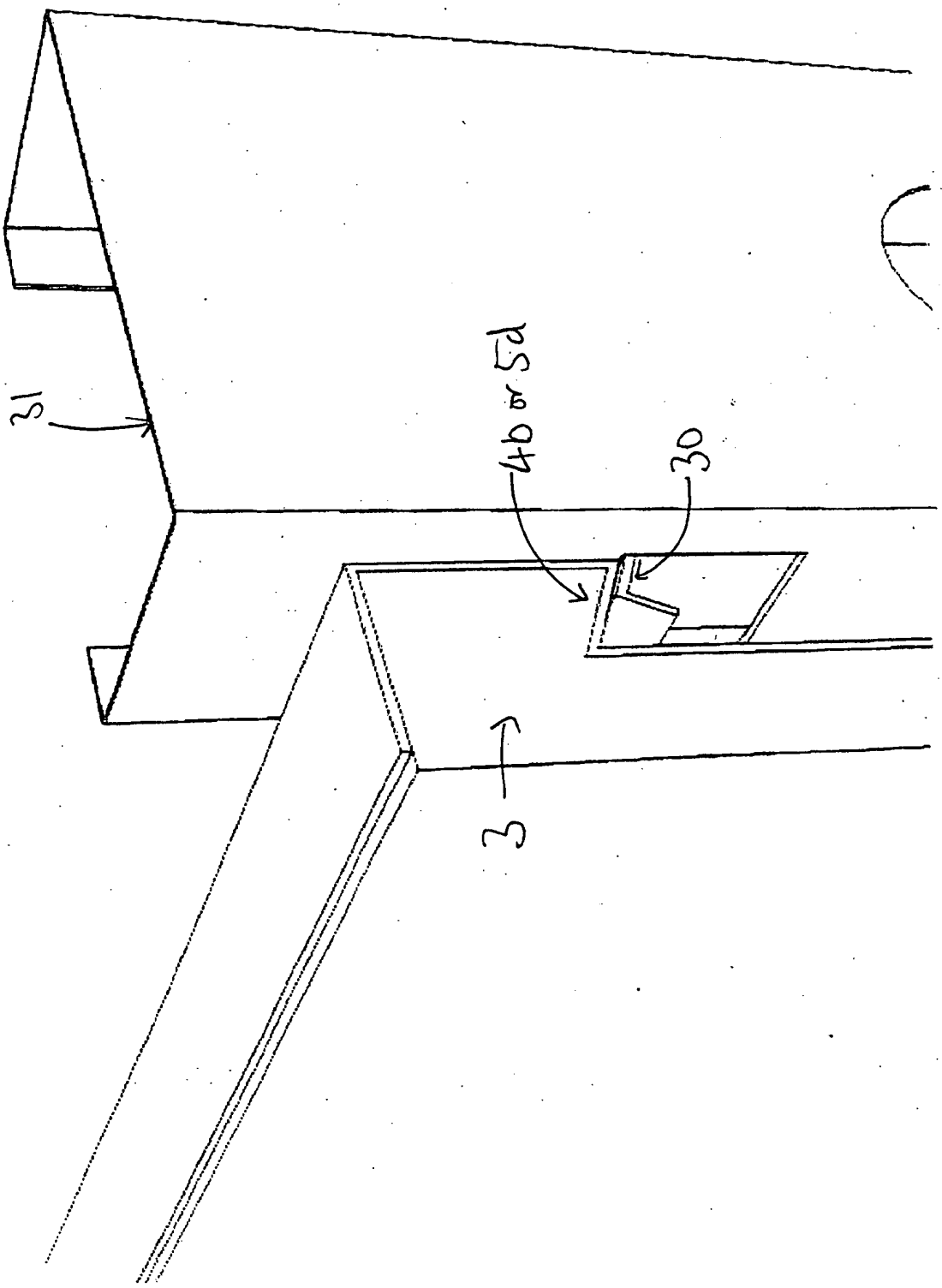


FIG 11